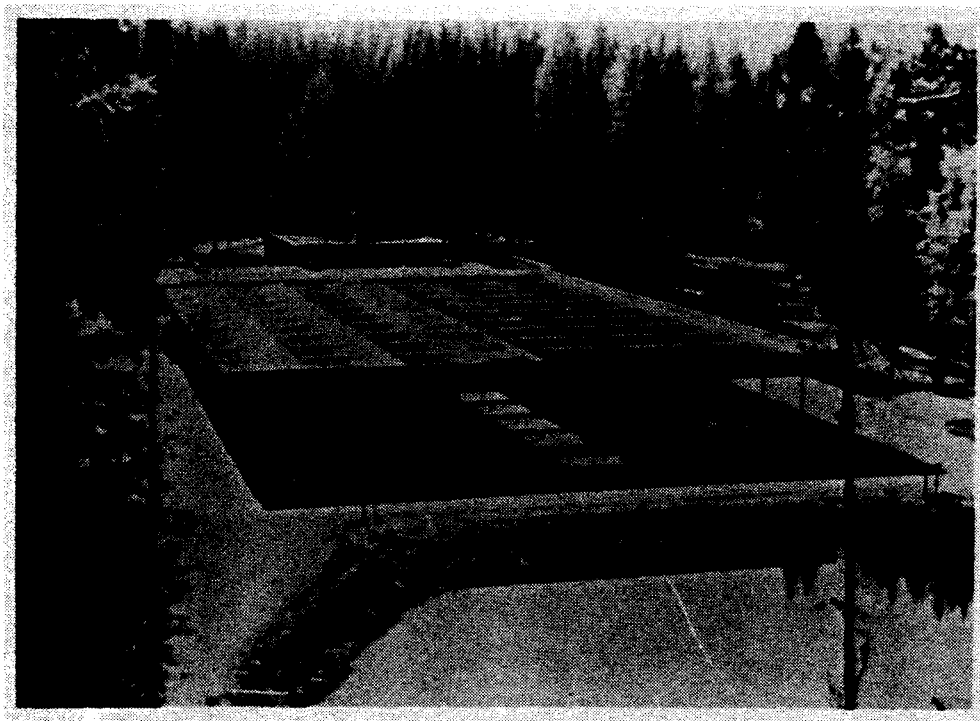




McCALL SUMMER CHINOOK SALMON HATCHERY

BROOD YEAR 1985
PRODUCTION REPORT



by
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ABSTRACT

McCall Summer Chinook Salmon Hatchery was the first hatchery built to enhance the salmon runs into Idaho under the Water Resources Development Act of 1976. A total of 1,410 adult salmon were trapped in 1985. From these, 2,073,546 eggs were taken from 477 females. Pahsimeroi Hatchery received 200,328 eyed eggs, 177,606 fry were released into Johnson Creek and 958,300 smolts were released into the South Fork of the Salmon River.

There were no major disease problems encountered during the rearing cycle at the hatchery. Survival from green egg to smolt was 65%. "Spring Thing" accounted for approximately 2% loss during the months of April and May 1986.

Two experiments dealing with early rearing of summer chinook salmon were conducted. An evaluation of early rearing densities showed fry could be reared at up to four times the recommended densities with little apparent effect. Also, an evaluation of timing of initial feeding indicated that fry could be held off of feed until they reached approximately 1,800 temperature units.

The production of 958,300 smolts and 177,606 fry required 76,871 pounds of feed for a conversion of 1.61 pounds of feed per pound of fish. The feed cost was \$0.68 per pound of fish produced.

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INTRODUCTION

Hydroelectric dams on the Columbia and Snake rivers have reduced Idaho's salmon runs to critically low levels. In 1976, Congress enacted the Water Resources Development Act, a portion of which is the Lower Snake River Fish and Wildlife Compensation Plan (LSRCP). The LSRCP compensates Idaho for losses of fish and wildlife caused by the Lower Snake River Projects (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams). The McCall Summer Chinook Hatchery was the first hatchery built as partial fulfillment of the LSRCP.

LOCATION

McCall Hatchery was constructed in 1979 by the U.S. Army Corps of Engineers. Operational funds are provided by the U.S. Fish and Wildlife Service (USFWS), and the facility is staffed and operated by the Idaho Department of Fish and Game (IDFG). The hatchery is located within the city limits of McCall, Idaho, on the North Fork Payette River approximately 0.16 km (1/4 mi.) downstream from Payette Lake.

OBJECTIVES

The objectives of the McCall Summer Chinook Salmon Hatchery are to:

1. Restore summer chinook salmon (Oncorhynchus tshawytscha) to the South Fork of the Salmon River, historically a major summer chinook stream in Idaho.
2. Trap and spawn adult salmon returning to the South Fork of the Salmon River.
3. Raise 1,000,000 summer chinook smolts for release in the South Fork of the Salmon River.
4. Establish a summer chinook salmon egg bank for future reintroduction into other drainages.
5. Evaluate fish rearing capabilities of the McCall Hatchery.

FISH REARING FACILITIES

Fish rearing facilities include: 26 eight-tray stacks of Heath incubators; two fiberglass Heath troughs, 0.53 m x 4.72 m (1.75 ft. x 5.5 ft.); 14 concrete vats, 1.22 m x 12.19 m (4 ft. x 40 ft.); two outdoor concrete rearing ponds, 12.8 m x 60.96 m (42 ft. x 200 ft.); and one collection basin, 4.57 m x 30.78 m (15 ft. x 101 ft.). Designed capacity of the hatchery is 1,000,000 smolts averaging 37.4 fish per kg (17 fish per pound).

An adult trapping and spawning facility is located on the South Fork of the Salmon River near Cabin Creek, approximately 41.8 km (26 mi.) east of Cascade, Idaho. This facility is equipped with a removable weir; fish ladder; trap; two adult holding ponds, 3 m x 26.8 m (10 ft. x 88 ft.); and a covered spawning area. Water is supplied from the South Fork of the Salmon River through an 84 cm (33 in.) underground pipeline.

Holding capacity for the facility is approximately 1,000 adults (Appendix 3). At least one-third of the adults trapped are passed above the weir for natural spawning. Eggs collected at the facility are transported "green" to McCall for incubation, hatching, and rearing. Resulting smolts are transported back to the South Fork of the Salmon River for release.

WATER SUPPLY

Hatchery water is obtained from Payette Lake through a 91.4 cm (36 in.) underground pipeline. Water may be taken from the surface or from a depth of 15.25 m (50 ft.), thus providing the capability of obtaining the best water temperature available.

Through an agreement with the Payette Lake Reservoir Company, 570 liter per second (20 cfs) can be used for hatchery operations. Design criteria and production goals were established using this constraint, ensuring that the hatchery has enough water to meet its production goals.

Water quality analysis reveals a somewhat "distilled" system for rearing fish. Total hardness ranges from 6.30-7.06 mg CaCO₃/L, while pH stays at about 6.8. There are no problems with heavy metals, and although at times gas supersaturation has been detected, it has not posed any serious problems.

STAFFING

The hatchery is staffed with three permanent employees: a manager (Hatchery Superintendent II), an assistant manager (Hatchery Superintendent I), and a Fish Culturist. In addition, two eight-month and two three-month temporary employees are employed to assist during the busy field season.

FISH PRODUCTION

The weir and trap on the South Fork of the Salmon River were put in operation on June 20, 1985, and trapping operations continued until September 3, 1985. During this period, 2,238 salmon were trapped (Appendix 1).

Fork lengths were taken on all salmon that returned to the weir (Figs. 1 and 2). Jacks (<65 cm, 26 in.) represented 37% of the run this year. These fish are from the 1984 release of 269,880 smolts. The 1,304 four-year-old fish (65 to 89 cm, 26 to 35 in.) were returns from the 1983 release of 183,896 smolts, and the 164 five-year-old fish (>89 cm, 35 in.) that returned were from the 1982 release of 122,247 smolts.

Of the returning fish, 544 were adipose fin-clipped, indicating a coded wire tag. The snouts were collected and sent to the IDFG laboratory in Lewiston for tag recovery and code identification.

Spawntaking began on August 5, 1985, and concluded on September 5, 1985. There were nine separate egg takes in 1985. During this period, 346 males were used to fertilize the eggs from 477 females. The mean fecundity was 4,347 eggs per female. A total of 651 fish (318 females, 168 males, and 165 jacks) were released upstream of the weir to spawn naturally.

Trapping mortality was higher this year than last. There were 151 male, 37 jack, and 91 female mortalities, or 12.5% of the total trapped (See Fish Health). These fish were returned to the river below the weir after kidney imprints were taken.

There were no drugs or chemicals used on the adults, and all of the carcasses were given away after spawning. The Shoshone-Bannock Tribes received 450 jacks and 1 adult for distribution to tribal members. The rest of the fish were given to the general public on a first-come, first-served basis.

EARLY REARING

All of the eggs were water hardened immediately after fertilization in a 100 ppm titratable iodine solution for one hour. This solution was buffered with 0.5% sodium bicarbonate. The eggs were then rinsed in well water, iced down in coolers, and transported to the hatchery.

Approximately 2,365 cc (80 fluid oz.) of eggs were placed in incubator trays supplied with 22.7 lpm (6 gpm) flow. The number of green eggs was estimated using the displacement method.

The eggs eyed after accumulating approximately 500 daily temperature units (DTU), at which time dead eggs were removed using the salt flotation method. From the 2,073,546 green eggs collected, 1,552,082 eyed eggs (74.8%) were counted using the water displacement method and returned to the Heath incubators at 2,365 cc (80 oz.) per tray. The Pahsimeroi Hatchery received 200,328 of these eyed eggs.

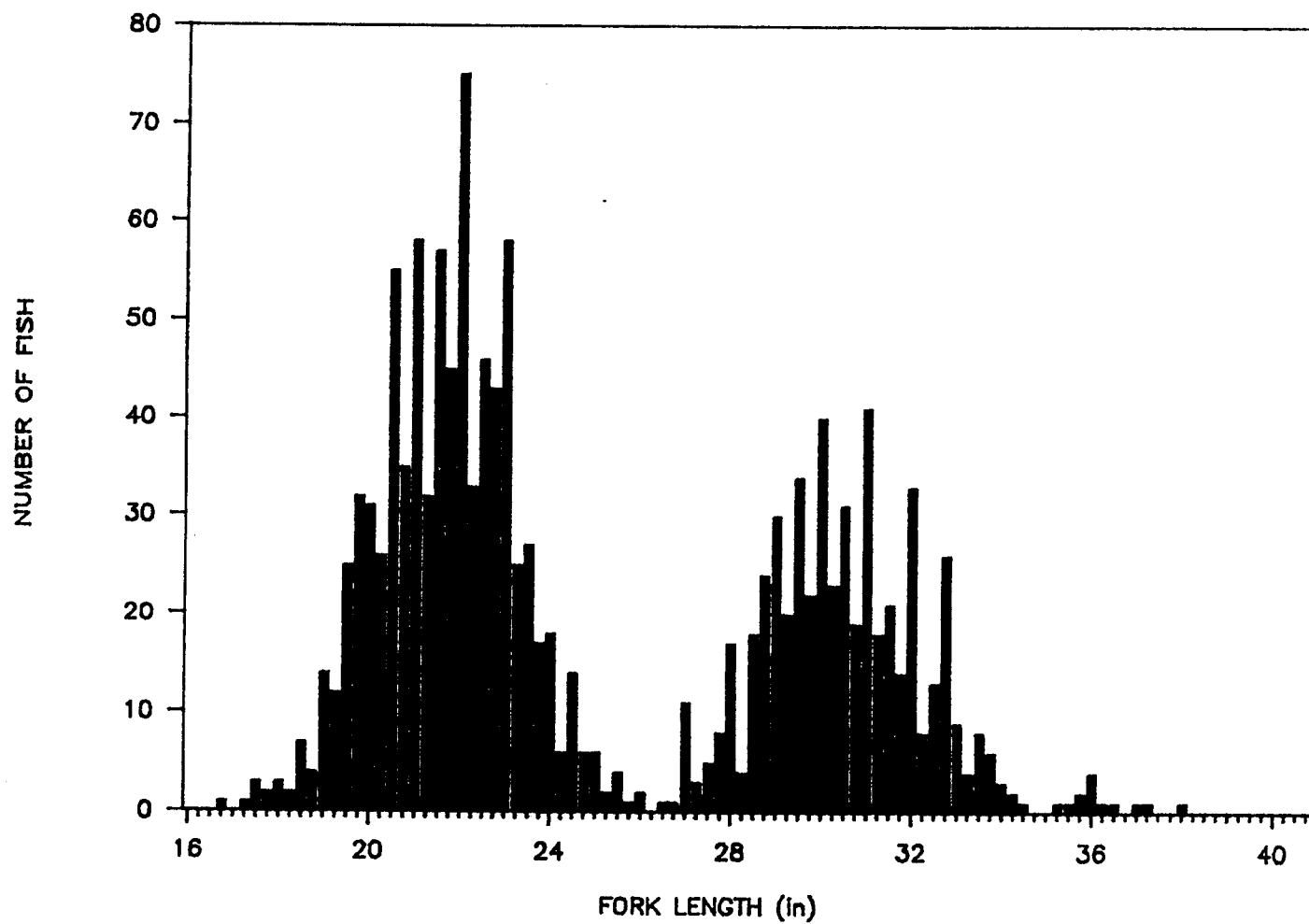


Figure 1. Length frequency of adult male summer chinook trapped on the South Fork Salmon River, 1985.

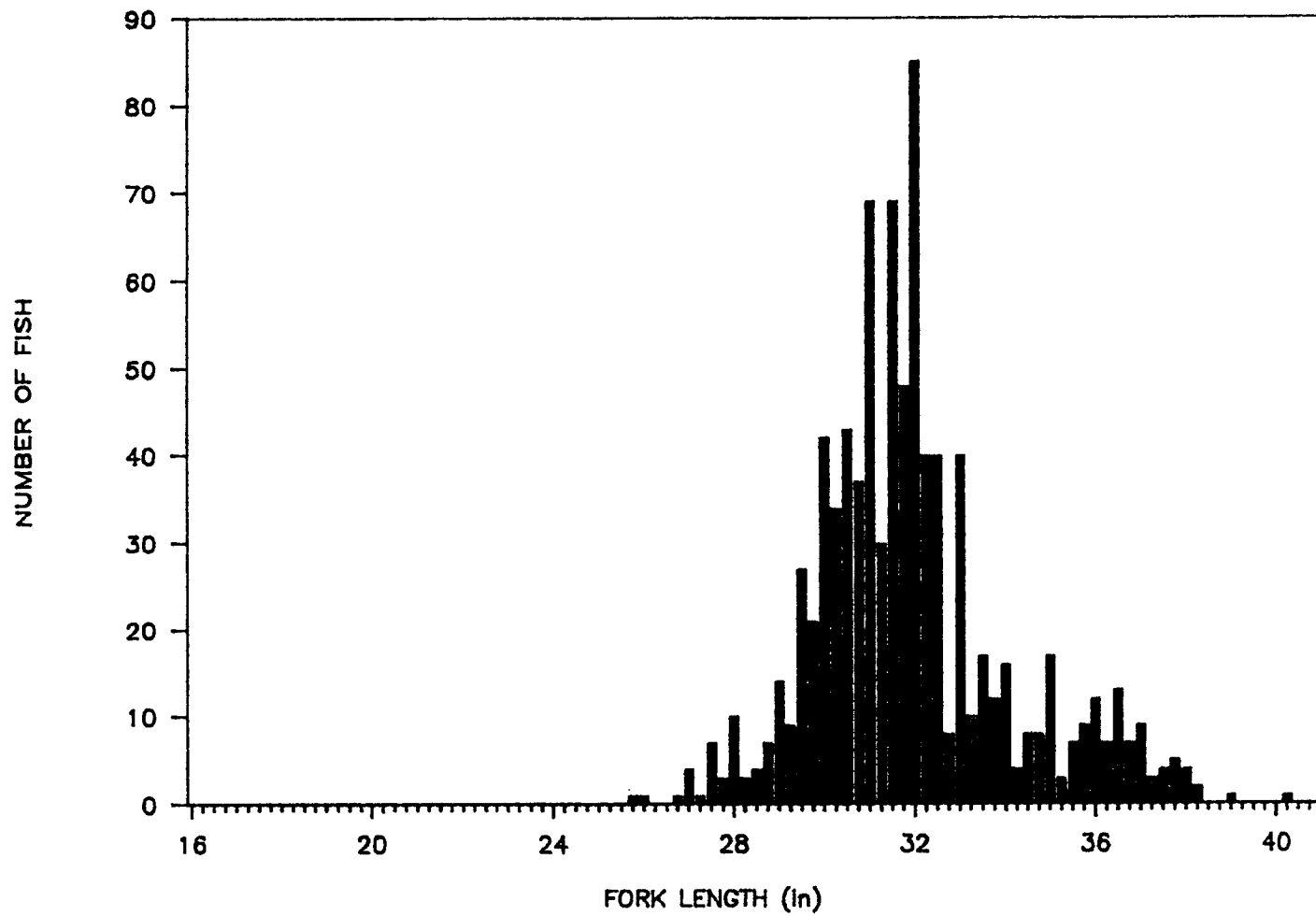


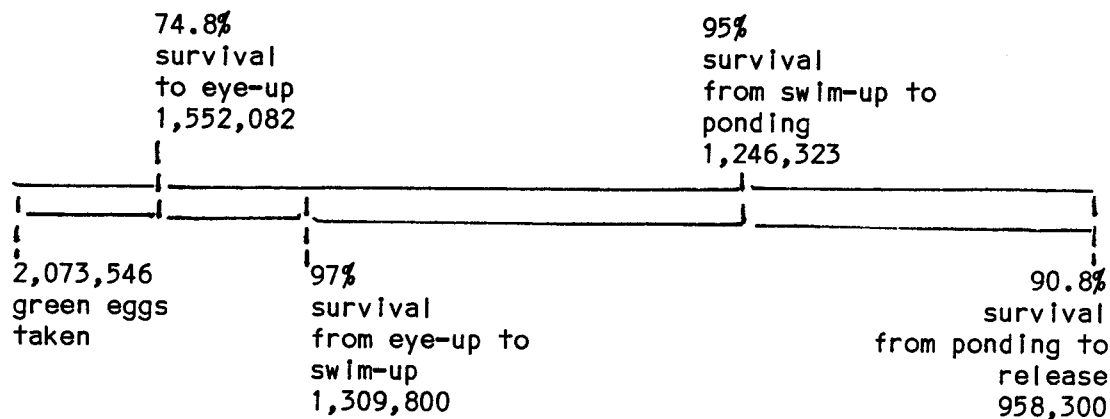
Figure 2. Length frequency of adult female summer chinook trapped on the South Fork Salmon River, 1985.

The remaining eggs hatched at approximately 900 DTU's, and swim-up fry were transferred to the vats after accumulating 1,600 DTU's. Of the 1,351,754 remaining eyed eggs, 1,309,800 swim-up fry (97% survival) were set out to the vats (Fig. 3). The normal initial loading rates ranged from 112,000 to 79,920 swim-up fry per vat. Two higher loadings were a part of a density experiment (See SPECIAL STUDIES).

The vat rearing volumes were established and changed by setting screens and drop gates at various distances and depths, ensuring that fish densities were maintained at or below the maximum density index (MDI) as recommended by Klontz (1979), with exception of the two density experiment vats. A flow index of approximately 0.3 to 0.4 was maintained throughout the indoor rearing phase and increased to a maximum of 0.82 immediately prior to ponding. The flows during indoor rearing ranged from 3 to 4 turnovers per hour, while the flows in the outdoor ponds were maintained at 1.3 to 1.5 turnovers per hour.

The fish were held in the indoor rearing vats until they were approximately 550 fish per kg (250 fish per pound). They were then transferred during May and early June to the outdoor ponds and reared there until they were released the following spring at 44.44 fish per kg (20.2 fish per pound). The survival rate of the 1,309,800 swim-up fry to ponding was 95%, or 1,246,323 fish (Fig. 3).

Figure 3. Survival summary of the 1984 brood year summer chinook at McCall Hatchery.



Water temperatures of 3 to 4° C (36 to 38° F) during early rearing at McCall resulted in extremely slow growth rates (Appendix 4). The daily length increase, (ΔL), during the coldwater rearing was only 0.127 mm (0.005 in.). As water temperatures increased, growth rates also increased. During the summer months, the daily length increases ranged between 0.254 and 0.584 mm (0.01 to 0.023 in.) due to warmer water.

The swim-up fry were initially fed OP-III starter mash (3% body weight) for the first two days on feed. For the next five days, they were fed a 1:1 mix of starter mash and OP-IV 0.8 mm (1/32) pellet, also at 3% body weight per day. For the remainder of the indoor rearing, they were fed the 0.8 mm (1/32) pellet at levels determined by the

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formula: %BW = hatchery constant/total length, where hatchery constant = Conversion x 3 x ΔL x 100 (Table 1) (Piper et al. 1982). The OP-IV diet had 10X the normal Pantothenic acid added to control the incidence of "Spring Thing." Once the fish were ponded outside, feed size changed as growth increased. The 3.175 mm (1/8 in.) OP-II pellet was the largest size fed to the presmolts. Feeding frequency varied with fish size and water temperature. Swim-up fry were fed hourly, fingerlings were fed six times per day, and presmolts were fed two to four times per day, depending upon the water temperature.

Table 1. Hatchery constants and feeding rates used at McCall Hatchery on summer chinook salmon during the growth period (above 38° F) for the brood year 1985 fish.

Month	Conversion	Δ	Total L.	HC	%BW	Temp.F
March	3.47	0.0044	1.67	4.58	2.75	37
April	2.87	0.0082	1.904	7.06	3.71	38.5
May	1.875	0.012	2.35	6.75	2.87	42
June	1.3	0.0237	3.00	9.243	3.08	53
July	1.35	0.0183	3.527	6.34	2.1	53
Aug.	1.4	0.0139	3.96	5.838	1.47	53
Sept.	1.68	0.0130	4.11	6.55	1.59	49
Oct.	1.595	0.0160	4.61	7.656	1.66	46
Nov.	1.71	0.0082	4.848	4.21	0.87	44
Dec.	1.24	0.0068	5.054	2.53	0.5	39

Fish were inventoried on the first and the fifteenth of each month. Length-weight relationships were determined, feeding levels adjusted, and the fish monitored for general health.

Hatchery vats were cleaned daily. Brushes and nets designated for each vat were disinfected in a 600 ppm benzalkonium chloride (50%) solution after each use. Mortalities were collected daily, recorded, and frozen for disposal. The outside rearing ponds were cleaned as needed by means of a vacuum system with discharge into the settling pond. Outside mortality was collected daily, recorded, and frozen for disposal.

FISH DISTRIBUTION

Fish Tagging

During the period October 27 to November 7, 1986, fish were coded wire tagged, fin clipped, and freeze branded. Of the 317,294 fish coded wire tagged and adipose clipped, 62,607 were branded on the left dorsal surface with a "R" in the third position (LD-"R"-3) (Table 2).

Table 2. Brood year 1985 coded wire tag codes and freeze brands used at McCall Hatchery.

Dates tagged	Pond number	Number tagged	Tag code	Remarks
10/27/87	1	105,660	10/30/19	
to	1	61,936	10/30/20	62,607
11/7/87				LD-"R"-3 freeze brand.
	2	44,411	10/30/20	
	2	<u>105,287</u>	10/30/21	
Total Marked		317,294		

A summary of the tags released is shown in Appendix 2. Numbers not adjusted for tag loss or mortality.

FISH RELEASE INFORMATION

On September 30, 1985, 200,328 eyed eggs were shipped to Idaho Power's Pahsimeroi Hatchery in an effort to reestablish the run of summer chinook salmon into that drainage.

On May 9, 1986, approximately 177,606 fry (125.2 kg, 276 pounds) were released into Johnson Creek and its tributaries to reintroduce summer chinook to this tributary of the South Fork Salmon River.

During the period March 30 to April 2, 1987, 958,300 smolts weighing 21,557 kg (47,425 pounds) were released into the South Fork of the Salmon River at the Knox Bridge. Of these, 311,825 smolts were carrying coded wire tags (Appendix 2). The smolts averaged 44.44 fish per kg (20.2 fish per pound) and 138 mm (5.43 in.) fork length (Fig. 4). This represented a 90.8% survival from ponding to release. Total survival from green egg to release was 65%.

IDFG pathologist Pat Chapman conducted a smolt quality assessment and found the fish to be in excellent condition at release. In addition, fish were sampled for descaling at the hatchery and also at the release site with no descaling evident at either sample site.

FISH HEALTH

During the spawning season, kidney imprints were taken on all adult holding pond mortalities. After the imprints were fixed in methanol, they were sent to the IDFG pathology lab for analysis via direct Fluorescent Antibody Technique (FAT) for bacterial kidney disease (BKD) Renibacterium salmoninarum. In addition, adults were sampled for

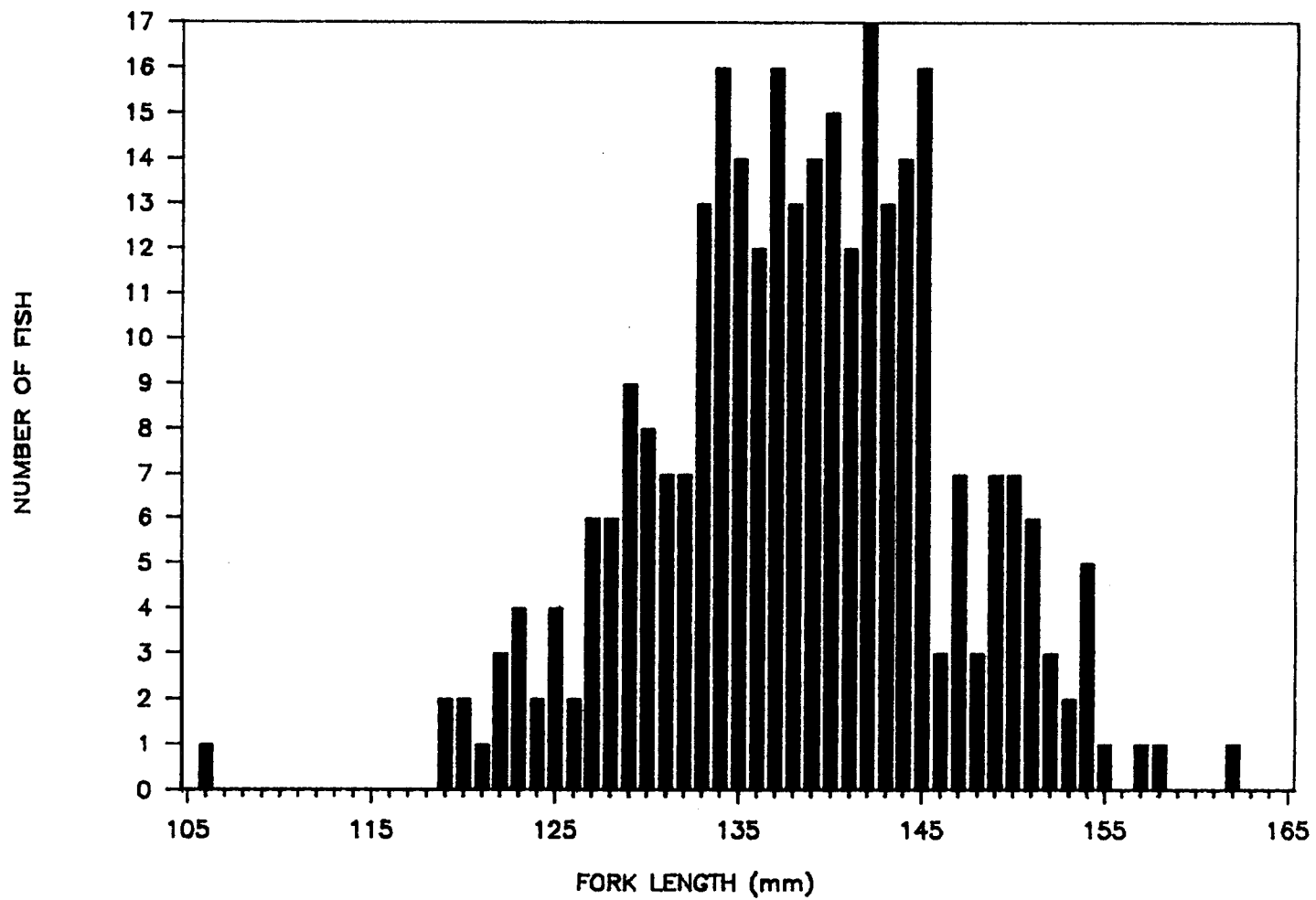


Figure 4. Length frequency of brood year 1985 summer chinook smolts.

various diseases during spawning on 8/19/87. Results were positive for infectious hematopoietic necrosis (IHN) virus and Ceratomyxa shasta; however, no titers were established for the virus, or the Ceratomyxa shasta organisms. Results were also positive for BKD in 8.3% of the fish sampled. Of the BKD-positive fish, 1.7% were lightly positive, 3.3% were moderately positive, and 3.3% were heavy positive.

There were minor disease problems with the brood year 1985 fish through their first winter. Internal fungus, diagnosed as Phoma herbarum, accounted for a slight increase in mortality during February 1986.

"Spring Thing" mortality began during April and accounted for a mortality rate of 2%. The use of ten times the normal level of pantothenic acid in the 1/32-inch OP-IV diet has shown to be beneficial in controlling the "Spring Thing" problem at McCall Hatchery (Hutchinson 1985).

After the fish were ponded outside, the fish displayed a chronic BKD infection. A ten-day treatment with erythromycin showed little apparent control. This disease became evident during June and caused sporadic loss patterns throughout the remainder of the final rearing cycle. The drugs, chemicals, and compounds used on the 1985 brood year fish are summarized in Appendix 3.

Results from smolt assessment conducted by IDFG pathologists were negative for all viral and bacteriological pathogens tested.

SPECIAL STUDIES

Density Experiment

As surplus eggs become available due to the success of the South Fork chinook program, there is a desire from IDFG biologists to outplant fry into underseeded areas of the drainage. If the hatchery can safely rear more fry than needed to produce 1,000,000 smolts, these fry can be used to reestablish populations in these historical spawning and rearing areas.

The hatchery was built for a MDI of 0.3 as suggested by Piper (1982). To stay within this design criteria, normal rearing densities have been set at 90,000 fry per vat. To determine the effect of increased early rearing density, the brood year 1985 fry were reared at varying rates of up to 250,000 fry per vat (MDI of 1.2).

Pat Chapman, IDFG Pathologist, sampled control and experimental fish and indicated that all fish had excellent fins and no pathogens were found. Both groups of fish were developing at approximately the same rate. All test fish were fed OP-IV with ten times the normal pantothenic acid added. This diet has been found to be the best diet for early rearing of summer chinook salmon at McCall Hatchery. Basic

water quality parameters were monitored on the first and fifteenth of each month that fish were in the hatchery vats. Results showed all vats to have excellent water quality.

At the termination of the experiment, the fish were weighed, and measured, and condition factors calculated. Conversion, mortality, and growth rates were calculated, and an overall population condition was evaluated. The only noticeable difference encountered was an increase in the length-frequency distribution of the high density fish. This experiment will be continued using brood year 1986 fry to verify this year's results.

INITIAL FEEDING STUDY

A study to determine the effects of timing of initial feeding was conducted at McCall on four groups of brood year 1985 fry. Fish were started on feed at 1,600 DTU's, 1,700 DTU's, 1,800 DTU's, and 1,900 DTU's, respectively. Each group consisted of three replicates. Each replicate consisted of 1,200 fry, which were held in baskets designed to simulate normal vat loading density indexes.

A total of 12 groups were counted and held in the Heath incubators until the designated age was reached. Fry were then transferred to floating baskets in a rearing vat and placed on feed. The fry were fed ad libitum hourly between 0800 and 1700 hours each day. The feed used was OP-IV with ten times the normal pantothenic acid added. This diet is used at McCall for all chinook fry.

Samples of ten fry were taken weekly from each basket. The fry were weighed, total lengths taken, and the body cavity was opened to determine the amount of feed in the gut and the volume of the remaining yolk. Yolk estimates were made using a simple 0,1,2 value system where 0 indicated there was no material present and 2 indicated a large volume of material present.

The amount of yolk present dropped to zero at about 1,875 DTU's from fertilization, corresponding with a sharp increase in fish weight (Figs. 4 and 5). Although feed was ingested shortly after it was presented in all groups, little growth occurred until the yolk was completely absorbed. This suggests that feed need not be presented until yolk absorption is nearly complete, at approximately 1,850 DTU's.

Normal hatchery procedure has the fry introduced to feed at 1,600 DTU's. If initial feeding was delayed until 1,850 DTU's, nearly 40 days of feed and manpower to clean the vats would be saved.

This experiment is to be repeated on brood year 1986 fry, using more definitive methods of measuring yolk and feed volumes to see if we can pinpoint the initial feeding age more closely.

ECONOMICS

A total of 34,899 kg (76,871 pounds) of Oregon Moist Pellets were fed to produce the 21,531 kg (47,425 pounds) of fish for this brood year. This resulted in a conversion rate of 1.62 pounds of fish feed per pound of fish produced. The feed cost per pound of fish produced was \$0.68. These figures do not include mortality losses.

LITERATURE CITED

Klontz, G. W. 1979. Fish Health Management, Volume I, University of Idaho Press. 142 p.

Piper, R. G., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Fowler, and J. R. Leonard. 1982. Fish Hatchery Management, United States Department of the Interior, Fish and Wildlife Service, Washington, D.C. 517 p.

Hutchinson, B. 1986. Final Report McCall Summer Chinook Nutrition Evaluation Study, Idaho Department of Fish and Game. 8 p.

Appendices

Appendix 1. McCall Hatchery summer chinook salmon adult return data by year.

Run date	Jacks	4-year males	4-year females	5-year males	5-year females	Total
1980	92	50	24	2	1	169
1981	124	171	135	31	63	524
1982	48	294	168	12	28	550
1983	504	108	164	85	76	937
1984	595	296	417	135	86	1,529
1985	828	467	792	47	104	2,238
1986	1,222	723	581	52	112	2,690

Appendix 2. Summary of the brood year 1985 tags released.

Tag code	Freeze brand			
	LD-"R"-3	10/30/19	10/30/20	10/30/31
Total marked	62,607	105,287	106,347	105,660
Total mortality	507	725	699	695
Mark loss <u>1.06%</u>	<u>0</u>	<u>1,111</u>	<u>1,122</u>	<u>1,115</u>
Marks released	62,100	103,450	104,525	103,850
Total marks released = 311,825				
Total fish released = 958,300				
Percent of population marked = 32.53%				

Appendix 3. Drugs, chemicals and compounds commonly used at McCall Hatchery.

Compound	Rate	Use	Source
erythromycin phosphate	4.5 gm/100 lb. fish/3 weeks	control BKD in fingerlings	Moore Clark feeds
iodophor	100 ppm titratable iodine 1 hr	disinfectant for eggs	Argent Chemical
sodium bicarbonate	0.5%	buffer for iodophor	common baking soda
formalin	1,667 ppm 15 minutes	control fungus on eggs	VanWaters & Rodgers
benzalkonium chloride	600 ppm 1 hr	topical disinfectant	Argent Chemical
chlorine	200 ppm 1 hr	topical disinfectant	VanWaters & Rodgers
sodium thiosulfate	5.6 gm/ gallon of 200 ppm cI	neutralize chlorine solution	VanWaters & Rodgers

Appendix 4. Correlation of summer chinook salmon smolts released by the McCall Hatchery and corresponding adult returns.

Brood year	Releases		Jacks	Returns			Percent return_
	Release date	Release number		4-year old	5-year old	Total	
1978	1980	124,800	124	462	161	747	0.598
1979	1981	248,926	48	272	221	541	0.217
1980	1982	122,247	504	713	151	1,368	1.119
1981	1983	183,896	595	1,259	203	2,057	1.119
1982	1984	269,880	828	1,265	*	**	**
1983	1985	564,405	1,222	*	*	**	**
1984	1986	970,483	*	*	*	**	**
1985	1987	953,300	*	*	*	**	**

* These fish have not returned yet.

** Incomplete due to unavailable data.

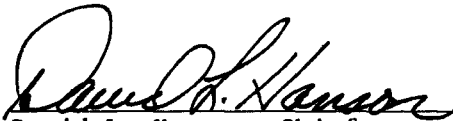
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